

## Minworth Wastewater Treatment Works

Bedford Pumps Ltd in partnership with Severn Trent Water, made a considerable contribution to a £145m upgrade at Minworth STW, Severn Trent's largest Sewage Treatment Works.

The plant located in Sutton Coldfield, Birmingham, has undergone substantial upgrading and renovation work. This includes a new Inlet Works, Primary Settling Tanks, increased ASB capacity, an Interstage Pumping Station and provision for future Biological Nutrient Removal.

Minworth STW covers approx 500 ha of land to the east of Birmingham and currently treats waste from the equivalent of 2.5 million people (1.75 m from the direct population and a further 750,000 due to tankered imports). To deal with this influx a major part of the extensive works was the construction of a new Settled Sewage Pumping Station on site. The sewage (on average 500 ml/d) arrives at the inlet via two large sewers where it is screened and settled. Pumps are then used to remove the sludge and transfer it to another part of the site for treatment.

Paul Fisher, project manager at Severn Trent states that "the inlet channel is like a major canal or a good size river rather than the usual sewer main pipe" and needs to handle a "pretty frightening" 30 m<sup>3</sup>/sec flow during maximum storm flow conditions. Bedford Pumps, chosen for their extensive knowledge and expertise in the field, worked alongside Severn Trent to provide the best possible pumping solution to contend with this.

Initially Severn Trent carried out a Whole Life Cost assessment of various pumps types (Screw Pumps, Submersible Volute Pumps, Conventional Lineshaft Bowl Pumps and Submersible Bowl Pumps). It was found that by a clear margin (a saving of £1.4M) submersible bowl units were the best option. The assessment took into account Civil Cost, M & E Cost, Power Consumption and Maintenance. With the decision made, Severn Trent then approached Bedford Pumps to assist with design.

Bedford Pumps then submitted no less than nine options, and two of these were selected for final Whole Life Cost analysis. This method is defined by the Office of Government Commerce (OGC) as "A technique to establish the total cost of ownership. It is a structured approach that addresses all the elements of this cost and can be used to produce a spend profile of the product or service over its anticipated life-span". This identified a £1.4M cost saving in favour of the bowl pumps.



Bedford Pumps' mixed flow pumps



Canisters in place



Pump into the canister at Minworth STW

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After much discussion the submersible pump arrangement selected was an open-top canister arrangement, wet well vertical, with a cascade discharge via a vertical taper. No pipework or valves were required.

These type of pumps are designed as an efficient alternative to conventional shaft driven units and can be utilised in a variety of applications.

They offer the following features:

- High overall efficiency
- Ease of installation removal
- Lowest WLC
- No pipework or valves
- Clearly defined static lift
- Compact in-line design
- Solid cast construction
- Flameproof design (ATEX certified)
- Condition monitoring
- Wet or dry well applications
- Vertical, Horizontal or Inclined arrangement

The final selection was for six mixed flow pumps with a duty of 2,480 l/s each. However, at Minworth the pumps were required to provide additional return flows in the future. This will take place in three phases of construction, using the same pump and motor:

1. The initial phase (short term before gravity feed) will operate a maximum pumped flow of 13.15m<sup>3</sup>/s at 2.767m head.
2. The second phase (long term after gravity feed) will operate at a maximum of 11.05m<sup>3</sup>/s at 2.767m head.
3. The final future phase (after addition of BNR Plant) will operate at a maximum of 11.05m<sup>3</sup>/s at 5.1m head.

Severn Trent Water approached Bedford Pumps with a view to working in close partnership to design the station. The original brief was disarmingly simple; to pump a maximum flow of 12,400 l/s at an approximate head of 4 metres. Beyond this requirement everything was up for discussion, including the number of pumps, pump arrangement and the station civil structure.

Initially Bedford produced nine options, varying from four units to seven units, and with different impeller configurations. In discussion with Severn Trent it was agreed that Axial Flow impellers could not be used as the inherently unstable curve shape was not viable for

the range of flows and use of variable speed. That, combined with a further Whole Life Cost review, reduced the nine options to just two, and these were examined in minute detail, taking into account the diurnal flows into the station.

The final outcome was for six pumps in all (five duty plus one standby). The selection is “pitched” such the pump best efficiency point is at or very close to the most common flows, and an exercise was undertaken to ensure that the optimum number of pumps was clearly defined for all conditions. In the event it was found that three pumps running together for most of the time gave the best solution.

With the number of pumps defined, the station design quickly took shape, and an extensive Hydraulic Model test programme followed. Various pump arrangements were considered, and the chosen design was for an open-top “Cascade” canister design, which removed the need for any pipework or valves.

The process became more complex in time, with the introduction of two additional Phases, requiring a different set of hydraulic conditions. It was found that flexibility built into the chosen design meant that the pumps could handle the new duties without alteration.

It is remarkable to note that this was a major pumping station produced from scratch with neither a formal enquiry or specification having been produced. Credit is due to Severn Trent for taking the decision to progress this scheme in such an informal yet closely controlled manner, and the partnership worked extraordinarily well. The project was completed in just under two years.

For further information on this, or any other of our applications, please contact our Sales Team

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